

**WHAT IS CLAIMED IS:**

1. An image forming apparatus, comprising:  
a developer cartridge containing a toner and detachably mountable into an apparatus main body;  
a cartridge storage means for saving intrinsic information including information on the life of the developer cartridge provided in the developer cartridge; and  
a first main-body controlling means for writing improper detachment information for making an improper detachment of said developer cartridge from the apparatus main body recognizable in said cartridge storage means.
2. An image forming apparatus according to claim 1, wherein said first main-body controlling means writes the improper detachment information in said cartridge storage means of said developer cartridge at the time of mounting said developer cartridge into the apparatus main body.
3. An image forming apparatus according to claim 2, wherein said first main-body controlling means reads information written in said cartridge storage means of said developer cartridge at the time of mounting said developer cartridge into the apparatus main body to judge whether or not the improper detachment information is written, and writes the

improper detachment information in said cartridge storage means when it is judged that the improper detachment information is not written.

4. An image forming apparatus according to claim 3, wherein said first main-body controlling means executes an abnormality processing when judging that the improper detachment information is written in said cartridge storage means of said mounted developer cartridge.

5. An image forming apparatus according to claim 3, further comprising:

a main-body storage means provided in the apparatus main body;  
and

a life calculating means for calculating a life value corresponding to a remaining amount of the toner in said developer cartridge and renewably saving the calculated life value in said main-body storage means,

wherein

said first main-body controlling means reads at least the information on the life written in said cartridge storage means and writes it in said main-body storage means when judging that the improper detachment information is not written in said cartridge storage means, and

said life calculating means calculates an added value of values corresponding to an amount of toner consumed at every image forming operation and calculates the life value based on the calculated added value

and the information on the life written in said main-body storage means.

6. An image forming apparatus according to claim 5, further comprising:

a cartridge supporting means which is movable relative to the apparatus main body and into which at least one developer cartridge is mountable;

a driving means for driving said cartridge supporting means to position said cartridge supporting means at least to a specified detachment position and a specified reading/writing position; and

a drive controlling means for controlling the operation of said driving means to control the positioning of said cartridge supporting means,

wherein

the detachment position is such a position where said developer cartridge can be detached through a developer cartridge opening formed in the apparatus main body,

the reading/writing position is such a position where the reading and writing from and in said cartridge storage means by said first main-body controlling means are possible,

upon a detachment instruction to detach said developer cartridge from the apparatus main body, said first main-body controlling means reads the information written in said cartridge storage means of said developer cartridge to judge whether or not the improper detachment

information is written, and executes a detachment preparation during which the life value is written in said cartridge storage means as the information on the life and the improper detachment information is cleared when it is judged that the improper detachment information is written, and

said drive controlling means first positions said cartridge supporting means to the reading/writing position upon the detachment instruction and then positions said cartridge supporting means to the detachment position after the completion of the detachment preparation by said first main-body controlling means.

7. An image forming apparatus according to claim 6, wherein said first main-body controlling means executes an abnormality processing when it is judged that the improper detachment information is not written in said cartridge storage means of said developer cartridge to be detached.

8. An image forming apparatus according to claim 6, further comprising a cover for closing the developer cartridge opening, wherein said driving means stops driving said cartridge supporting means when said cover is opened.

9. An image forming apparatus according to claim 6, wherein said cartridge supporting means is so constructed as to rotate said developer cartridge about an axis of rotation substantially normal to an opening plane of the developer cartridge opening.

10. An image forming apparatus according to claim 6, further comprising:

a cover for closing the developer cartridge opening; and

a detecting means for detecting open and closed states of said cover,

wherein said drive controlling means judges that said developer cartridge has been mounted into the apparatus main body when said cover is detected to have been closed after being opened with said cartridge supporting means located at the detachment position after the completion of the detachment preparation.

11. An image forming apparatus according to claim 1, wherein said first main-body controlling means reads information written in said cartridge storage means of said developer cartridge to judge whether or not the improper detachment information is written when a predetermined storage controlling condition is satisfied with said developer cartridge mounted in the apparatus main body, and writes the improper detachment information in said cartridge storage means when it is judged that the improper detachment information is not written.

12. An image forming apparatus according to claim 11, wherein the storage controlling condition is satisfied when the apparatus is turned on.

13. An image forming apparatus according to claim 11, wherein the storage controlling condition is satisfied when the number of prints made reaches a predetermined value.

14. An image forming apparatus according to claim 11, wherein the storage controlling condition is satisfied when a print command signal is inputted from an external apparatus.

15. An image forming apparatus according to claim 11, further comprising:

a main-body storage means provided in the apparatus main body;  
and

a life calculating means for calculating a life value corresponding to a remaining amount of the toner in said developer cartridge and renewably saving the calculated life value in said main-body storage means,

wherein said first main-body controlling means saves at least the information on the life written in said cartridge storage means in said main-body storage means when it is judged that the improper detachment information is not written in said cartridge storage means, and

said life calculating means calculates an added value of values corresponding to an amount of toner consumed at every image forming operation and calculates the life value based on the calculated added value

and the information on the life saved in said main-body storage means.

16. An image forming apparatus according to claim 15, further comprising:

a cartridge supporting means which is movable relative to the apparatus main body and into which at least one developer cartridge is mountable;

a driving means for driving said cartridge supporting means to position said cartridge supporting means at least to a specified detachment position and a specified reading/writing position; and

a drive controlling means for controlling the operation of said driving means to control the positioning of said cartridge supporting means,

wherein

the detachment position is such a position where said developer cartridge can be detached through a developer cartridge opening formed in the apparatus main body,

the reading/writing position is such a position where the reading and writing from and in said cartridge storage means by said first main-body controlling means are possible,

upon a detachment instruction to detach said developer cartridge from the apparatus main body, said first main-body controlling means executes a detachment preparation of updating the information on the life saved in said cartridge storage means of said developer cartridge to the life

value renewably saved in said main-body storage means, and of clearing the improper detachment information, and

said drive controlling means first positions said cartridge supporting means to the reading/writing position upon the detachment instruction and then positions said cartridge supporting means to the detachment position after the completion of the detachment preparation by said first main-body controlling means.

17. An image forming apparatus according to claim 16, wherein said first main-body controlling means reads the information written in said cartridge storage means of said mounted developer cartridge to judge whether or not the improper detachment information is written when said developer cartridge is mounted into the apparatus main body, and executes an abnormality processing when it is judged that the improper detachment information is written.

18. An image forming apparatus according to claim 16, further comprising a cover for closing the developer cartridge opening, wherein said driving means stops driving said cartridge supporting means when said cover is opened.

19. An image forming apparatus according to claim 16, wherein said cartridge supporting means is so constructed as to rotate said developer cartridge about an axis of rotation substantially normal to an



opening plane of the developer cartridge opening.

20. An image forming apparatus according to claim 16, further comprising:

a cover for closing the developer cartridge opening; and

a detecting means for detecting open and closed states of said cover,

wherein said drive controlling means judges that said developer cartridge was mounted into the apparatus main body upon detecting that said cover was closed after being opened with said cartridge supporting means positioned at the detachment position after the completion of the detachment preparation, and positions said cartridge supporting means to the reading/writing position.

21. A method for controlling the storage of information on an improper detachment of a developer cartridge in an image forming apparatus in which a developer cartridge containing a toner is detachably mountable into an apparatus main body and a cartridge storage means for saving intrinsic information including information on the life of said developer cartridge is provided in said developer cartridge, said method comprising the steps of:

writing improper detachment information for making the improper detachment of said developer cartridge from the apparatus main body recognizable in said cartridge storage means; and

clearing the improper detachment information written in said cartridge storage means upon a detachment instruction to detach said developer cartridge from the apparatus main body.

22. A method according to claim 21, wherein said step of writing the improper detachment information in said cartridge storage means is performed at the time of mounting said developer cartridge into the apparatus main body.

23. An image forming apparatus, comprising:  
a developer cartridge containing a toner and detachably mountable into an apparatus main body;

a cartridge storage means for saving intrinsic information including information on the life of said developer cartridge provided in said developer cartridge; and

a second main-body controlling means,

wherein a cartridge exchange mode in which said developer cartridge is exchanged is provided as an operation mode in addition to an image forming mode in which the image formation is carried out, and

said second main-body controlling means is provided to write exchange completion information indicating that the exchange has been normally completed in said cartridge storage means at a specified timing in the cartridge exchange mode.

24. An image forming apparatus according to claim 23, further comprising:

a cartridge supporting means which is movable relative to the apparatus main body and into which at least one developer cartridge is mountable;

a driving means for driving said cartridge supporting means to position said cartridge supporting means at least to a specified detachment position and a specified reading/writing position; and

a drive controlling means for controlling the operation of said driving means to control the positioning of said cartridge supporting means,

wherein

the detachment position is such a position where said developer cartridge can be detached through a developer cartridge opening formed in the apparatus main body,

the reading/writing position is such a position where the reading and writing from and in said cartridge storage means by said second main-body controlling means are possible,

said second main-body controlling means reads information written in said cartridge storage means of said developer cartridge to be exchanged to judge whether or not the exchange completion information is written at the start of the cartridge exchange mode, and executes an exchange preparation of clearing the exchange completion information when it is

judged that the exchange completion information is written, and

said drive controlling means first positions said cartridge supporting means to the reading/writing position at the start of the cartridge exchange mode and then positions said cartridge supporting means to the detachment position after the completion of the exchange preparation by said second main-body controlling means.

25. An image forming apparatus according to claim 24, further comprising:

a main-body storage means provided in the apparatus main body;  
and

a life calculating means for calculating an added value of values corresponding to an amount of toner consumed every time a series of image forming operations are performed in the image forming mode, calculating a life value corresponding to a remaining amount of the toner in said developer cartridge based on the added value, and renewably saving the calculated life value in said main-body storage means,

wherein said second main-body controlling means renewably writes the life value as the information on the life in said cartridge storage means of said developer cartridge to be exchanged as the exchange preparation.

26. An image forming apparatus according to claim 25, wherein

said second main-body controlling means reads, in the cartridge exchange mode, the information written in said cartridge storage means of said developer cartridge mounted into the apparatus main body to judge whether or not the exchange completion information is written, and reads at least the information on the life written in said cartridge storage means and writes it in said main-body storage means when it is judged that the exchange completion information is not written, and

said life calculating means calculates the life value based on the information on the life and the added value.

27. An image forming apparatus according to claim 26, further comprising:

a cover for openably closing the developer cartridge opening; and  
a detecting means for detecting open and closed states of said cover,

wherein said drive controlling means judges based on a detection result of said detecting means whether or not said cover has been closed after being opened with said cartridge supporting means positioned at the detachment position after the completion of the exchange preparation, and positions said cartridge supporting means to the reading/writing position upon judging that said developer cartridge to be exchanged was detached and another developer cartridge was mounted into the apparatus main body when said cover is detected to have been opened and closed.

28. An image forming apparatus according to claim 27, wherein said driving means stops driving said cartridge supporting means when said cover is detected to be opened.

29. An image forming apparatus according to claim 28, further comprising a detachment recovery processing means for executing a specified detachment recovery processing when said second main-body controlling means judges that the exchange completion information is not written in said cartridge storage means of said developer cartridge to be detached at the start of the cartridge exchange mode.

30. An image forming apparatus according to claim 29, wherein said detachment recovery processing means

judges based on the detection result of said detecting means whether or not said cover has been opened and closed from the start of the cartridge exchange mode until said cartridge supporting means is positioned to the detachment position before executing the detachment recovery processing,

judges that said developer cartridge was improperly detached from the apparatus main body with the exchange completion information kept written therein when said cover is detected to have been opened and closed, and

as the detachment recovery processing, causes said drive controlling means to position said cartridge supporting means to the

detachment position for the exchange of said developer cartridge being mounted and judged to have no exchange completion information written therein, and displays a message urging the remounting of said improperly detached developer cartridge.

31. An image forming apparatus according to claim 30, wherein

said second main-body controlling means reads the information written in said cartridge storage means of said developer cartridge to judge whether or not the exchange completion information is written upon the remounting of said developer cartridge resulting from the detachment recovery processing by said detachment recovery processing means, and executes a re-exchange preparation of clearing the exchange completion information and of renewably writing the life value in said cartridge storage means when it is judged that the exchange completion information is written, and

the cartridge exchange mode is set until said second main-body controlling means completes the re-exchange preparation.

32. An image forming apparatus according to claim 29, further comprising an exchange instructing means operable by a user, wherein

the cartridge exchange mode is started when said exchange instructing means is operated by the user, and

said detachment recovery processing means judges, before

executing the detachment recovery processing, based on the detection result of said detecting means whether or not said cover has been opened and closed between the start of the cartridge exchange mode and the time when said cartridge supporting means is positioned to the detachment position, judges that said developer cartridge to be exchanged was improperly detached from the apparatus main body with the exchange completion information kept written therein when said cover is detected to have been opened and closed, and, as the detachment recovery processing, displays a message urging to operate said exchange instructing means again.

33. An image forming apparatus according to claim 32, wherein:

said second main-body controlling means reads the information written in said cartridge storage means of said developer cartridge to judge whether or not the exchange completion information is written upon the remounting of said developer cartridge resulting from the detachment recovery processing by said detachment recovery processing means, and executes a re-exchange preparation of clearing the exchange completion information and of renewably writing the life value in said cartridge storage means when it is judged that the exchange completion information is written, and

the cartridge exchange mode is set until said second main-body controlling means completes the re-exchange preparation.



34. An image forming apparatus according to claim 28, further comprising a mounting recovery processing means for executing a specified mounting recovery processing when said second main-body controlling means judges that the exchange completion information is written in said cartridge storage means of said another developer cartridge judged to have been mounted into the apparatus main body.

35. An image forming apparatus according to claim 34, wherein

said mounting recovery processing means gives an improper detachment notification that said developer cartridge being mounted is the one that was improperly detached from the apparatus main body before with the exchange completion information kept written therein as the mounting recovery processing, and

said second main-body controlling means reads at least the information on the life written in said cartridge storage means of said developer cartridge being mounted and writes it in said main-body storage means after the improper detachment notification by said mounting recovery processing means.

36. An image forming apparatus according to claim 24, wherein said cartridge supporting means is so constructed as to rotate said developer cartridge about an axis of rotation substantially normal to an

opening plane of the developer cartridge opening.

37. A method for controlling the storage of information on the completion of the exchange of a developer cartridge in an image forming apparatus in which said developer cartridge containing a toner is detachably mountable into an apparatus main body, a cartridge storage means for saving intrinsic information including information on the life of said developer cartridge is provided in said developer cartridge, and a cartridge exchange mode in which said developer cartridge is exchanged is provided in addition to an image forming mode in which the image formation is carried out, said method comprising, in the cartridge exchange mode, the steps of:

writing exchange completion information indicating that the exchange has been normally completed in said cartridge storage means of said developer cartridge mounted into the apparatus main body at the time of mounting said developer cartridge; and

clearing the exchange completion information from said cartridge storage means of said developer cartridge to be exchanged.

38. An image forming apparatus, comprising:

a developer cartridge containing a toner and detachably mountable into an apparatus main body;

a cartridge storage means for saving intrinsic information including information on the life of said developer cartridge provided in said

developer cartridge; and

a third main-body controlling means for reading information written in said cartridge storage means of said developer cartridge being mounted when a power supply is restored from an improper shutoff thereof.

39. An image forming apparatus according to claim 38, wherein

a cartridge exchange mode in which said developer cartridge is exchanged is provided as an operation mode in addition to an image forming mode in which the image formation is carried out, and

said third main-body controlling means writes exchange completion information indicating that the exchange has been normally completed in said cartridge storage means at a specified timing in the cartridge exchange mode and judges whether or not the exchange completion information is written in said cartridge storage means of said developer cartridge being mounted when the power supply is restored.

40. An image forming apparatus according to claim 39, further comprising:

a cartridge supporting means which is movable relative to the apparatus main body and into which at least one developer cartridge is mountable;

a driving means for driving said cartridge supporting means to

position said cartridge supporting means at least to a specified detachment position and a specified reading/writing position; and

a drive controlling means for controlling the operation of said driving means to control the positioning of said cartridge supporting means,

wherein

the detachment position is such a position where said developer cartridge can be detached through a developer cartridge opening formed in the apparatus main body,

the reading/writing position is such a position where the reading and writing from and in said cartridge storage means by said third main-body controlling means are possible,

said third main-body controlling means reads information written in said cartridge storage means of said developer cartridge to be exchanged to judge whether or not the exchange completion information is written at the start of the cartridge exchange mode, and executes an exchange preparation of clearing the exchange completion information when it is judged that the exchange completion information is written, and

said drive controlling means first positions said cartridge supporting means to the reading/writing position at the start of the cartridge exchange mode and then positions said cartridge supporting means to the detachment position after the completion of the exchange preparation by said third main-body controlling means.

41. An image forming apparatus according to claim 40, further comprising:

a main-body storage means provided in the apparatus main body;  
and

a life calculating means for calculating an added value of values corresponding to an amount of toner consumed every time a series of image forming operations are performed in the image forming mode, calculating a life value corresponding to a remaining amount of the toner in said developer cartridge based on the added value, and renewably saving the calculated life value in said main-body storage means,

wherein said third main-body controlling means renewably writes the life value as the information on the life in said cartridge storage means of said developer cartridge to be exchanged as the exchange preparation.

42. An image forming apparatus according to claim 41, wherein

said third main-body controlling means reads, in the cartridge exchange mode, the information written in said cartridge storage means of said developer cartridge mounted into the apparatus main body to judge whether or not the exchange completion information is written, and reads at least the information on the life written in said cartridge storage means and writes it in said main-body storage means when it is judged that the exchange completion information is not written, and

said life calculating means calculates the life value based on the

information on the life and the added value.

43. An image forming apparatus according to claim 42, further comprising a power supply restoration recovery processing means for executing a specified power supply restoration recovery processing when said third main-body controlling means judges, at the time of restoring the power supply, that the exchange completion information is not written in said cartridge storage means of said developer cartridge being mounted.

44. An image forming apparatus according to claim 43, wherein said power supply restoration recovery processing means gives an improper mounting notification that said developer cartridge being mounted is the one that was improperly mounted without writing the exchange completion information as the power supply restoration recovery processing.

45. An image forming apparatus according to claim 44, wherein said third main-body controlling means reads at least the information on the life written in said cartridge storage means of said developer cartridge being mounted and writes it in said main-body storage means after the improper mounting notification by said power supply restoration recovery processing means.

46. An image forming apparatus according to claim 45,

wherein said power supply restoration recovery processing means judges that the improper mounting had been done during the improper shutoff of the power supply before the power supply was restored and displays a message urging the re-exchange of said developer cartridge detached from the apparatus main body during the shutoff of the power supply as the power supply restoration recovery processing.

47. An image forming apparatus according to claim 40, wherein said cartridge supporting means is so constructed as to rotate said developer cartridge about an axis of rotation substantially normal to an opening plane of the developer cartridge opening.

48. An image forming apparatus according to claim 38, wherein said third main-body controlling means performs the reading and writing from and in said cartridge storage means only during the cartridge exchange mode except at the time of restoring the power supply.

49. An image forming apparatus according to claim 38, further comprising:

a nonvolatile memory provided in the apparatus main body for saving improper power-supply shutoff information indicating that the power supply was improperly shut off; and

a power-supply application judging means for reading information written in said nonvolatile memory when the apparatus is turned on to

judge whether or not the improper power-supply shutoff information is written, and judging that the apparatus is turned on to restore the power supply from the improper shutoff when it is judged that the improper power-supply shutoff information is written,

wherein said third main-body controlling means reads the information written in said cartridge storage means of said developer cartridge being mounted when said power-supply application judging means judges that the apparatus is turned on to restore the power supply from the improper shutoff.

50. A method for controlling the storage of information on the completion of the exchange of a developer cartridge in an image forming apparatus in which said developer cartridge containing a toner is detachably mountable into an apparatus main body, a cartridge storage means for saving intrinsic information including information on the life of said developer cartridge is provided in said developer cartridge, and a cartridge exchange mode in which said developer cartridge is exchanged is provided as an operation mode in addition to an image forming mode in which the image formation is carried out, said method comprising the steps of:

writing exchange completion information indicating that the exchange has been normally completed in said cartridge storage means of said developer cartridge mounted into the apparatus main body at the time of mounting said developer cartridge in the cartridge exchange mode; and



reading information written in said cartridge storage means of said developer cartridge being mounted at the time of restoring a power supply from an improper shutoff.